Research and development agenda

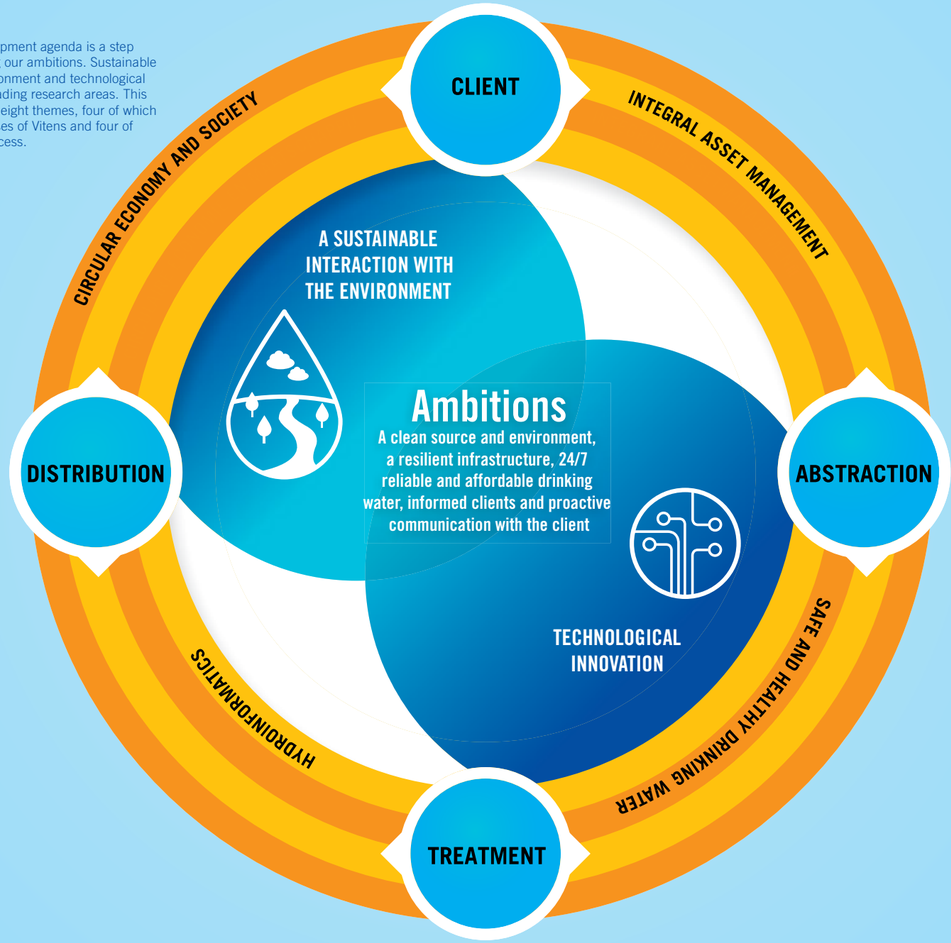
Drinking water for the future

2018 – 2022

Vitens

CONTENT

This research and development agenda is a step forward towards reaching our ambitions. Sustainable interaction with the environment and technological innovation are the two leading research areas. This document is divided into eight themes, four of which relate to the core processes of Vitens and four of which go beyond the process.



PREFACE

‘Through cooperation we can make the most of our opportunities’

Our company stands for reliable drinking water for every moment of the day, for every one of the 5.6 million clients in our service area. We deliver drinking water not only to the current generation, but to future generations as well. As a water company, we must be able to adequately deal with (unexpected) developments in society, with societal challenges facing us as a country as well as the changing needs of our clients.

Research and innovation are required for every department of our company, especially since we want to create a resilient base for the future. Because our ambitions are so high, our company cannot realise them on its own. We firmly believe that through cooperation with other institutions, market players, technology suppliers and other water companies, we will be able to make more out of the opportunities we see. Only together can we guarantee a truly sustainable future.

‘We are able to take on more opportunities, while cooperating’

This booklet elaborates the subjects on which our attention is focussed regarding research and innovation. Our hope is that everyone involved in drinking water will think with us and contribute to our efforts to turn our ambitions into reality.

On behalf of the management board of Vitens and all theme ambassadors,

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Do you have any questions, comments or ideas concerning this booklet?
Please contact our Innovation Manager, Jan Gooijer, at Jan.Gooijer@vitens.nl

Creating a reliable and sustainable plan together

The context in which we provide our services as a water company is constantly changing, which presents us with challenges. Technological innovation and a sustainable interaction with the environment are increasing in importance. Both aspects enhance the resilience of our water company, improving our ability to react to (unexpected) changes. These challenges also require specific research and innovation, in cooperation with several market and knowledge institutions.

As a water company, we are at the centre of society. We depend and anticipate on developments in society, such as the demand for drinking water, energy transition, climate change, digitalisation and economic growth. These are all developments with a considerable uncertainty factor and take place much faster now than ever before. This results in challenges for an infrastructure that usually has a long technical lifetime.

We make choices for well into the future, but in the long run, some of these choices could be challenged.
As a water company, we must enhance our resilience without losing our reliability. We see many opportunities for doing so, particularly by investing in a sustainable interaction with the environment and technological development.

Production plant Vechterweerd near Dalfsen applies bank filtration. This plant provides drinking water to ten percent of the residents of the province of Overijssel.

A sustainable interaction with the environment
To deliver top-quality drinking water, we depend on the availability of high-quality water sources. Clean groundwater is our highest priority. However, these sources are vulnerable, primarily because of increasing pressure on the environment and because of energy transition requirements. To realise a clean environment, we must cooperate intensively with stakeholders in the areas from which our water is abstracted, with cooperation both above and below ground.
This requires a broader spectrum, integral assessments based on risks, durable cooperation and synergy between our goal and those of others: in short, new insights and approaches.

Round-table meeting of the Vitens Board of Directors and staff

Technological innovation

Society is digitalising under the influence of technological development, a rapid process that offers many possibilities to optimise our reliability, resilience, supply of information and service to clients. We see opportunities for real-time monitoring of the production and distribution of drinking water, for automating these processes and for making the right choices based on insight whenever we have to solve problems. In this manner, we can improve our reaction to changes in water quantity and quality and communicate transparently and proactively about it. The new technology that is needed for this has additional requirements for research and innovation.

To realise these ambitions, profound insight is necessary, both into the individual steps of the water production process and into the process as a whole. The technical innovation and research required for this exceed the regular development of knowledge in our departments because the physical infrastructure that we possess has to comply with the demands of the moment. For example, consider the design of a distribution network that measures water quality real-time, an autonomously controlled treatment process or the usage of sustainable materials in building the infrastructure. However, social research and innovation is necessary as well, because we must possess the knowledge, insights and methods to adequately react to changes through integral assessment frameworks, data models and a clear vision of customer requirements.
This innovation and research agenda points out the subjects that have our attention and that we will use to realise our objectives.

Support us

This booklet is an invitation to support us. We wish to contact everyone who can help us in realising our ambitions. We like to be surprised by new knowledge, innovation and ideas that may help us with our duty as a water company not only for the present, but also for future generations. We also need the assistance of research institutions, knowledge institutions and educational institutions for the implementation of projects described in this booklet. By this, we mean a call to action for everyone both inside and outside of the sector to think and work with us, from experimental set-up to implementation.

Formation

This agenda is derived from the strategic vision and mission of Vitens, as well as from the visions of others. Wide-ranging visions and goals were developed by the organisation and influenced by external developments, of which this agenda presents a complete overview. Vitens' vision documents include:

Themes

The agenda is divided into eight themes, including:
- the four core processes of Vitens (Abstraction, Treatment, Distribution and Client);
- four process-transcending themes (Hydroinformatics, Integral asset management, Circular economy and society, and Safe and healthy drinking water.)

For each theme, research questions have been prepared by a team of colleagues from various departments. In addition, a broad, multiannual theme plan has been set up, with ambitions, long-term objectives and extensive work packages with clustered questions. This theme plan also contains annual plans in which the required investments and internal capacity are presented. When we (are about to) enter into a collaboration, this

Open Day at the production company in Heek

theme plan will be shared confidentially with external parties. Theme ambassadors are responsible for the plan's implementation, the connection between the theme and our ongoing business activities, as well as for external contacts.

Theme ambassadors

Abstraction
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Circular economy and society
Shelitha van Hunen - Shelitha.vanHunen@vitens.nl
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Objectives

This agenda contains two important objectives. The first objective is to apply focus and structure in ongoing and planned research and innovation projects within Vitens. The second objective is to serve as a call to market parties, knowledge institutions and research institutions to assist us.

A call to market parties, knowledge institutes and research agencies to help us.

A call to market parties, knowledge institutes and research agencies to assist us.

Scope

The development of knowledge and insights —as well as keeping these up-to-date — is done everywhere within our organisation. This is of course part of our daily operations, but is also project-based, when certain subjects deserve more attention.
This innovation and research agenda focusses on strategic questions that need additional research and innovation within the next four years. These questions:

- cannot be answered with existing knowledge;
- are motivated by the vision and strategy of Vitens;
- are either experimental in nature or demand new practice-oriented or scientific research. If necessary, they could be carried out together with expert partners or other organisations;
- exclude strategic research outside of the research agenda; and
- are of a multidisciplinary nature and cross departments.

Starting event of the 'Protect your drinking water' campaign in Gelderland

RESEARCH AREA

Sustainable connection with our environment

We do not produce drinking water on our own. We depend on a sufficient number of groundwater sources, and these sources are vulnerable. Their quality and availability are influenced by factors such as climate change and economic activity. Similarly, the production of drinking water influences the environment. We must therefore possess a perfect view of the connection between our activities and those of others, both above and below the ground. Particularly, because we are more connected than ever and the available space is more limited. Together with stakeholders we face new challenges.

This situation requires a resilient infrastructure that is resilient enough to react properly to unexpected situations, yet is still 24/7 reliable without requiring any adaptation. We must be aware of each other's concerns, consider things integrally and utilise each other's talents. This is important when dealing with difficult social challenges supported by technology and data, such as sustainability and circularity. This is how we build lasting relationships.

Most important themes within this area:

INSPIRATIONAL CASES

Vitens works in different ways to establish a sustainable interaction with the environment. The following pages show three inspirational cases.

INSPIRATIONAL CASE NGinfra

Along with the Port of Rotterdam, Schiphol, ProRail, Alliander and Rijkswaterstaat, Vitens takes part in NGinfra (Next Generation Infrastructures). As infrastructure managers, we share and develop the required knowledge within this collaboration in order to improve the Dutch infrastructural achievements and to create sustainable networks. We can learn a lot from each other when it comes to asset management, such as with regard to data analysis and monitoring, infrastructure availability and signalling technological developments. Furthermore, we are more and more connected and dependent on each other. Collaboration allows us to make better use of each other's strengths, to improve our networks and to make a contribution to national tasks, such as energy transition and improving the quality of life.

INSPIRATIONAL CASE HumVi

Thanks to ion exchange, humic acid can be removed from drinking water. By using this technique, it is possible to create high-quality drinking water from water that is normally difficult to treat. The residue is separated by various membrane techniques. This results in three different streams: water, salt and humic acid. Water and salt can be reused in the ion exchange regeneration process, while we make a unique and natural soil conditioner from humic acid. The product is called HumVi and is used in the agricultural sector.

INSPIRATIONAL CASE Sand filter

Vitens invests in scientific research into the functioning of sand filters. Almost every production site is equipped with sand filters. These filters remove iron, ammonium and manganese from the water. Due to the complexity of the process, we currently have insufficient understanding of the functioning of the sand filter. Therefore, modelling and automation are difficult. However, through combining different disciplines on a scientific scale, such as process technology and microbiology, we hope to obtain this understanding.

THEME

Abstraction

Water tower Deventer, designed by city architect Jan Anthony Mulock Houwer (1892).
The abstraction of water in Deventer is one of Vitens' oldest projects.

Our water sources are our most important assets as a water company. Without a reliable water source, high-quality drinking water is impossible. The quality and availability depend on how we and other stakeholders treat(ed) our water sources and the environment in the areas where water is abstracted, both above and below ground. We want to limit our spatial claim as much as possible without taking irresponsible risks.

Motive for more research

Decline in groundwater quality
In general, the quality of groundwater in the Netherlands has declined in the previous century, mainly due to human influences such as agricultural effects, (veterinary) medicines and urban soil contamination. There is also an increased influence of surface water.

Spatial pressure
Available space is becoming more restricted. In some cases, this leads to competition between different parties when it comes to the use of that space. Apart from groundwater, the subsoil offers possibilities for geothermal energy and thermal energy storage systems. In social assignments, such as energy transition, this can cause conflicting interests. The same applies to agricultural activities in rural areas, where the use of various fertilisers can adversely affect drinking water quality.

Soil processes
More precipitation, higher temperatures and more evaporation: these are the prospects of the future. They influence the physical, biological and chemical processes in the soil. Because of the influence of climatic change, the quality and quantity of both drinking water and surface water are changing.

OBJECTIVES OF THIS RESEARCH THEME

- A resilient use of our water sources and a durable interaction with the environment
- Insight into required production, costs and risks per source and how these can be optimised and managed together (now and in the future)
- A sustainable protection policy with which we can sufficiently protect abstractions from risks

The Natuurtuin, part of the Engelse Werk Abstraction site in Zwolle, is open to the general public.

WORK PACKAGES

The soil as filter 0

The goal of this work package is to monitor changes in the quality of groundwater, based on insights into (cyclic) processes in the soil, and utilising the soil as a first purification stage. For this, we study techniques such as early warning systems, satellite imagery, sensors and modelling, which can be used for this purpose.

Managing risks

The goal of this work package is to gain insight into the (prospective) effects of agriculture, surface water and soil energy systems on the abstraction of water, and to find effective ways to deal with these effects. We want to be adaptive if possible and preventive when necessary.

Sustainable protection

The goal of this work package is the development of a risk-driven protection policy (partly through hydrological modelling), with which we limit our spatial claim while contributing to other assignments for safeguarding the abstraction of water in the long term.

Questions, recommendations or advice? Please contact Johan Driessen, at Johan.Driessen@vitens.nl

THEME

Circular economy and society

At production site Spannenburg, gas is abstracted from the groundwater and then used as an energy source in the production process.

As a water company, we are at the centre of society. We intensively work together with clients, shareholders and stakeholders on our core task. Due to current developments, such as economic growth and spatial pressure, we must remain in balance with our environment. We cannot ignore national and international challenges, such as energy transition and circular economy. As a country, we face an important tipping point: transforming thinking into doing!

Motive for more research

Circular economy

We want to adapt our use of commodities and render it more circular by seeking high-value markets for by-products. The protection of natural water and soil cycles, combined with the mitigation of negative repercussions from agricultural activities, can offer possibilities for a clean water supply. This requires a transformation in the system: a change in thinking, designing, purchasing, managing and replacing. It also requires innovative collaboration with the market and stakeholders.

Innovative collaboration

Increasingly, we are being held accountable on our social impact and asked to contribute to cross-functional demands or opportunities. We seek to reinforce joint functions. For example, we try to contribute to nature development when developing new water abstractions. However, our activities can also cause conflicts, such as when economic activities have a negative influence on the quality of groundwater. In both cases, it is necessary to cooperate innovatively, under the right conditions. We will have to create synergy where our tasks merge with those of others.

Energy transition

The Netherlands is switching to alternative sources, such as solar energy and wind energy. This transition is required and unavoidable, and Vitens is also involved in this process. As a major energy consumer, we must depend on reliable energy sources and are expected to make a sustainable energy plan. Energy transition increases the use of the underground due to geo-thermal and shale gas systems. This puts pressure on the implementation of groundwater sources.

OBJECTIVES OF THIS RESEARCH THEME

- Proactively cooperating with stakeholders and (together) using opportunities in the transition to sustainable energy and a circular economy
- Visibility of our social role as a water company and, in doing so, an increased commitment to the subject of drinking water

WORK PACKAGES

Circular business processes
The goal of this work package is to render the use of commodities more sustainable and enhance reuse from source to tap, from supplier to customer and from employee to client. We perform research into the possibilities of closing the material and commodity cycles (and corresponding revenue models).

Agricultural influences on soil cycles
The goal of this work package is to gain insight into the influences of agriculture on soil cycle processes and groundwater by utilising innovative data analysis and satellite data, among others.

Cooperation
The goal of this work package is to present a clear picture of Vitens' role regarding other social challenges (for example, underground initiatives related to energy transition) and the possible cooperation with other stakeholders in these areas. The (legal) conditions for the combination of functions and the possibilities for innovative procurement are important subjects in this respect.

Energy transition
The goal of this work package is to gain insight into the impact of energy transition on our business processes and the contribution we can make as a water company. This includes reducing energy consumption, using alternative sources and limiting CO2 emissions.

Questions, recommendations or advice? Please contact Shelitha van Hunen, at Shelitha.vanHunen@vitens.nl

Vitens generates approximately 1.2 megawatts peak through 4462 solar panels at five sites. Shown below is the Engelse Werk production site.

THEME

Integral asset management

Leidsche Rijn production site in Utrecht

We do not only make choices for our drinking water infrastructure for the next few years, but for decades and more to come. However, in present times, we must be able to respond much quicker to developments without losing our reliability. We thus consider strategic choices, such as with regard to which sources we use and which capacity our pipes should have, in an integrated manner. This relates to desired achievements, as well as risks and costs (over the entire lifetime of the asset).

Motive for more research

Resilience

Uncertainties in the future, such as, developments in drinking water demand and the quality of the source cause challenges for the drinking water infrastructure. This is because we make choices today and tomorrow that will have an influence on the distant future, while we can only look a few years ahead from now. Therefore, we must respond promptly when unexpected changes in quality or quantity present themselves. For this reason, we choose resilience, a combination of robust infrastructural solutions that can cope with changes without requiring adaptations and solutions that enhance our flexibility. Deep groundwater abstraction is a robust solution, and real-time monitoring of the risks in the soil increases our flexibility. A resilient infrastructure requires other choices, procedures and ways of balancing options (see also long-term vision Veerkrachtig Vooruit).

Insight

Technological progress, such as with ICT and data modelling, provides more insight into the risks, costs and desired achievements of every step of the drinking water production process, from (the protection of) the source to the client. By knowing more, we will make and balance choices differently and will be able to respond more adaptively to changes. Therefore, different options to choose from are essential.

Societal dynamic

Shortage of space, technological developments, decentralisation, demand for transparency, urbanisation, shrinkage and energy transition are all developments that have an influence on our field of work and force us to consider choices more accurately.

OBJECTIVES OF THIS RESEARCH THEME

- A better functioning asset management process with more insight into choices (and their motivation) and the possibility to control, manage and maintain in an ever-changing context
- Insight into the risks, costs and desired achievements, from (the protection of) the source to the client. By this, we also mean social and economic developments and the (financial) condition of assets.

Vitens and Liander are replacing water and gas pipelines together

WORK PACKAGES

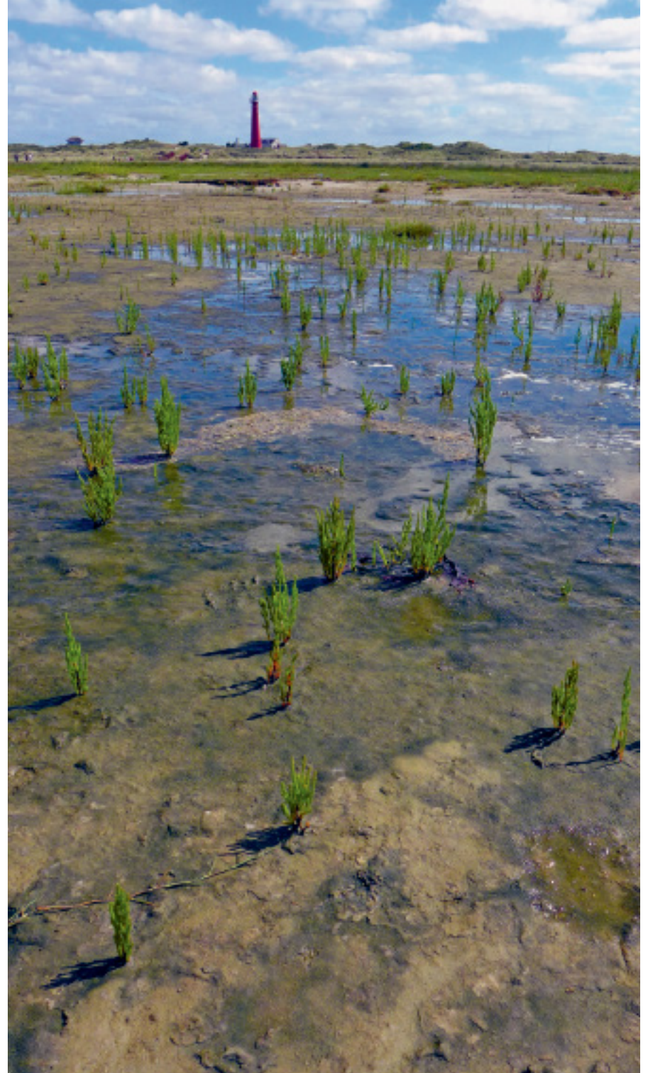
Resilient drinking water supply

The goal of this work package is the development of a resilient drinking water supply. To achieve an appropriate response to changes, an assessment framework is required in order to anticipate changes on the basis of information (e.g. about disruptive developments), as well as gain insight into the possibilities of enlarging the resilience of the infrastructure.

The value of assets

The goal of this work package is to gain more insight into the (real) risks, lifetime and (financial) valuation of our technical and natural assets. The manner in which we can measure and record these elements is a part of this. Our focus is on recording the desired performance of a resilient infrastructure, such as in cases of permitting activities in the abstraction area.

Questions, recommendations or advice? Please contact Rian Kloosterman, at Rian.Kloosterman@vitens.nl



RESEARCH AREA

Technological innovation

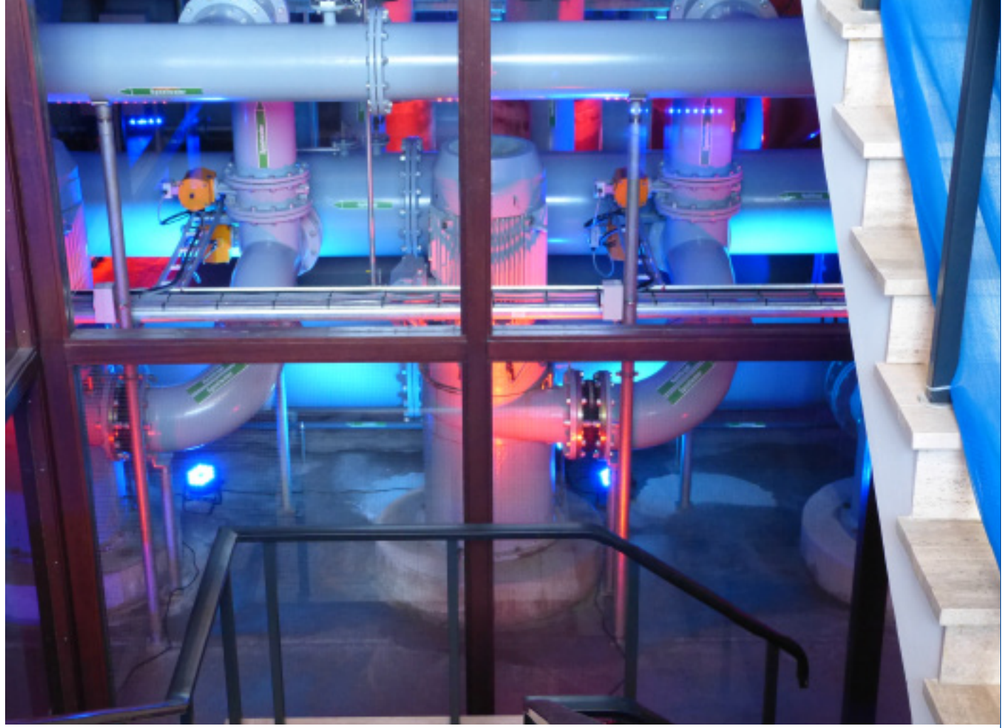
Since the introduction of the Internet, many innovations have improved the drinking water supply and communication with our clients. However, this is just the beginning. The digitisation and development of new methods and techniques in our field create many other possibilities that cannot be left out. Through technological innovation, we can improve our ability to respond to social changes and the needs of our clients.

Real-time monitoring and measuring the whole drinking water production process from (protection of) the source to satisfied clients is therefore our ambition. We want to contribute to the realisation of optimal control and fact-based decisions (for each individual step of the process as well as the process as a whole). We also want to contribute to transparent internal and external communication, to optimising our service and to a higher degree of reliability as a water company. We invest in the knowledge and resources that are necessary to render our drinking water infrastructure sustainable through technology.

Most important themes within this area:

INSPIRATIONAL CASES

Vitens already works in different ways to establish technological innovation. The next few pages show three examples for inspiration.



INSPIRATIONAL CASE SLIMM

The SLIMM project aims the development of models and softsensors for real time monitoring and control of drinking water treatment plants. The first phase of SLIMM was a proof of principle project at WTP Oldeholtpade. Here several softsensors were succesfully developed. Now in the second phase these softsensors are tested at another 6 different water treatment plants. The main objective is to calibrate and validate the developed softsensors at each site and the development of dashboards with real time water quality information.

INSPIRATIONAL CASE

Smart Grid Friesland Live!

Vitens is the first water company in the world to install an extensive and intelligent drinking water network. This network is being implemented in Friesland. A pipeline network with a length of 9,000 kilometres will be provided with 200 sensors, which register live what happens in the pipeline network. This real-time data is then translated into information that is relevant for the management. In this case, the focus is on real-time control of leakage, monitoring the water quality and a proactive communication with the client.

INSPIRATIONAL CASE

Water Battle

The Water Battle is a serious game to raise the awareness of children and parents regarding water consumption and the peak load on the water network. Through a game for children and an app for parents that is connected to a smart water meter, households are stimulated to improve the way they spread their water consumption over the day. The desired change in water consumption during peak moments is rewarded with points, with which players can reach new levels in the game. In this way, parents and children are extra-motivated and ready to cooperate in order to achieve a high score in the game.

THEMA

Hydroinformatics

The digitalisation of society creates plenty of possibilities. Technology and data (modelling) make it possible to monitor and control processes and infrastructure from the source to the tap (and the environment around it). This helps us improve the execution of tasks while taking different scenarios for the future into account. We call this hydroinformatics, which is the application of ICT and data analysis specifically focused on water-related subjects.

Motive for more research

Technological innovation and data-driven operation

Twenty years ago, possessing a mobile phone was extraordinary. Nowadays, it is something we cannot live without. The speed at which new technologies and data analysis methods and models are developing is very high. This means that the chances and possibilities for a smart water supply are constantly increasing, such as self-learning systems and algorithms to predict the quality of water. ICT and data are a constant theme in research and innovation, and therefore requires a focussed approach.

Smart society

Technology transforms (the facilities of) our society and the way we live and work. Digitalisation and urbanisation merge in smart cities and are combined with other challenges, such as energy transition and mobility. We see possibilities for contributing to a smart society with an intelligent water network that surpasses water supply.

Security

Unfortunately, cyberattacks and the leakage of private information occur more often now than before. Hackers can hack digital systems and infect them with viruses and ransomware. Security of systems and data is essential when applying ICT, especially in matters such as drinking water.

OBJECTIVES OF THIS RESEARCH THEME

- Developing and experimenting with new data-related knowledge and tools that can optimise the drinking water process and can lead to a higher degree of client satisfaction
- Excellent real-time insight into every step of the process
- Data-driven control, with an intelligent water network designed for safety

WORK PACKAGES

An intelligent water network in society
The goal of this work package is to contribute to a sustainable and smart society through an intelligent water network. Smart industries and open data are important building blocks in this regard.

Real-time information and model-based control
The goal of this work package is accomplishing real-time insight into every step of the process through sensors and the Internet-of-Things, as well as into the correct methodology for communicating this information.

Artificial intelligence and Advanced analytics
The goal of this work package is to accomplish an algorithm-driven drinking water production process from source to tap by using advanced analytics and artificial intelligence. The realisation of early warning systems to protect the network - as well as response strategies - are a part of this.

Security
The goal of this work package is the realisation of an intelligent water network that has been designed for safety from the start. Research into securing Internet-of-Things networks is a part of this.

Questions, recommendations or advice? Please contact Jorik van Vilsteren, at Jorik.vanVilsteren@vitens.nl

Replacement of old water mains

THEME *Distribution*

Drinking water infrastructure is capital-intensive and has a long technical lifetime. Its design therefore requires insight into future developments such as urbanisation, client behaviour, water consumption and climate change. All of these are developments with a considerable uncertainty factor. Even so, our distribution network must be sustainable in every conceivable scenario, as well as able to provide the desired quality and quantity of water. An integrated consideration of performance, costs and risks is essential.

Prototype of an autonomous inspection robot (AIR) that remains in the pipeline for a long period of time and charts the state and location of smaller pipes

Motive for more research

Replacement and maintenance

A considerable part of our distribution pipes will require replacement or maintenance in the years to come. This offers opportunities, but challenges as well. As we once more have to make design choices, we can design our distribution network as cost-effectively as possible. However, this may never be done at the expense of reliability. Whether to repair, replace or sanitize will be an integrated consideration.

Qualitative change in the network

The water source is not the only thing important for water quality. There are also factors following the treatment process that can influence water quality, including physical, chemical and biological processes. Interactions between the distributed water and pipe material or interactions within the bulk water are subjects that we still know too little about. Because of this, we may miss optimisation opportunities.

New technological possibilities

Modelling, Internet-of-Things and smart inspection techniques are all developments that we can use to enhance our achievements and expand our flexibility. The question is how to best integrate these into the design of existing and future networks.

OBJECTIVES OF THIS RESEARCH THEME

- Knowing the right (substantiated) design choices for a sustainable distribution network that is ready for implementing new techniques and that takes different future scenarios into account
- Gaining insight into the processes that affect the water quality and water flow in the distribution network
- Developing knowledge, insight and techniques that contribute to an optimised replacement policy

New pipelines and new materials before being laid into the ground

WORK PACKAGES

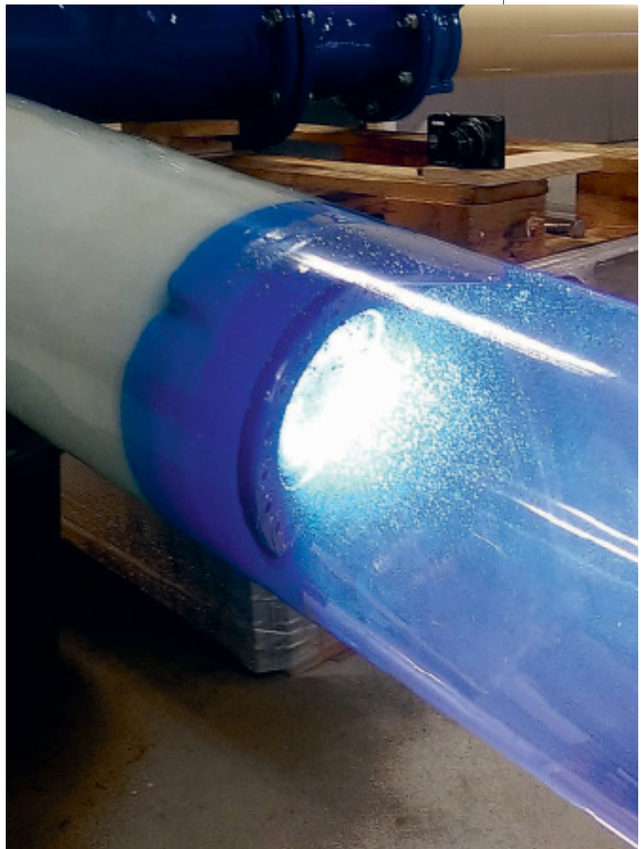
Designing a sustainable network
The goal of this work package is to gain insight into designing a sustainable distribution network that is ready for future technological developments (such as online monitoring and internal inspections) and able to respond quickly to unexpected incidents, while guaranteeing 24/7 reliability.

Optimisation of maintenance and remediation
The goal of this work package is to further develop knowledge and technologies (such as inspection technologies for pipelines) for integrally assessing maintenance and remediation issues (based on achievements, costs and risks).

Optimal drinking water quality for the client
The goal of this work package is to gain insight into factors that may influence the water quality, to be able to predict these (for example through data analysis and modelling) and to minimise the risks that may affect the water quality. This includes physical, chemical and (micro-) biological water quality processes, as well as interaction with the pipe material.

Questions, recommendations or advice? Please contact Eelco Trietsch, at Eelco.Trietsch@vitens.nl

The Pipeline Inspection Gauge (PIG) — Acquarius I — can be used to determine the condition of larger pipelines and is equipped with lighting for camera inspection and ultrasonic pipe inspection equipment.



THEME

Safe and healthy drinking water

The quality of the drinking water we provide is our highest priority. Clients must be able to naturally rely on the safety and quality of our drinking water. This is why it is our ambition to make the quality integrally measurable at every step of the process, thus enabling us to ensure top-quality drinking water. It is our desire to be transparent about this and to inform our clients and stakeholders accordingly. Within the theme of safe and healthy drinking water, our main concern is integral control of the quality from the source to the client.

Motive for more research

The quality of water at the source
Improved measurement techniques enable us to detect micro-contaminations in groundwater sooner. In the abstracted raw water, we often detect drug residues, pesticides and other substances of which the health risks are relatively unknown. In addition, we have detected that the influence of surface water on groundwater is growing, while activities in the soil (as part of energy transition) are increasing as well. Because of this, it is more difficult to predict the quality of the source, and traditional treatment methods may no longer be sufficient to guarantee the desired drinking water quality.

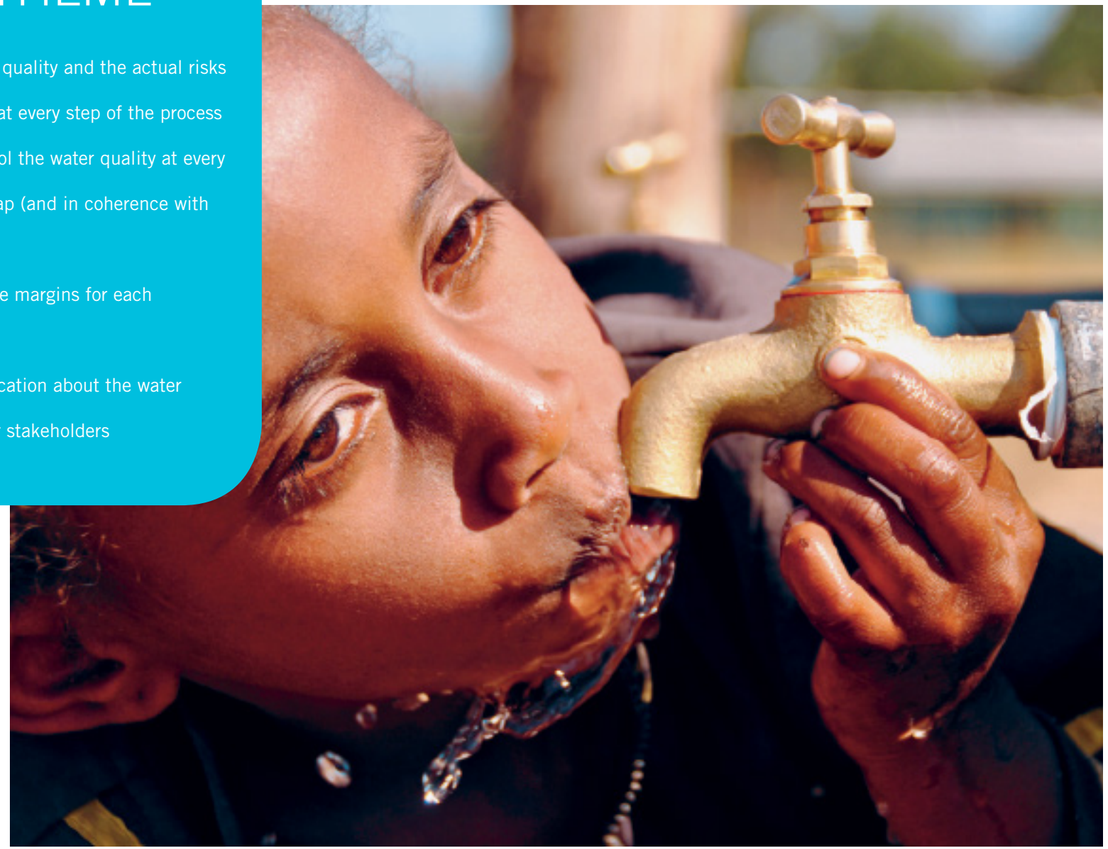
The influence of water treatment
Many of our production sites treat the abstracted groundwater using traditional methods, such as aeration and sand filtration. In line with The European Water Framework Directive and our preference for groundwater, we aim to minimize treatment efforts, while understanding optimally how this influences the water quality.

Factors in the pipeline network
Both after treatment and while it is in the pipeline, the drinking water quality can be influenced by chemical, physical and biological processes. The pipeline material (polythene, for example) and microorganisms may have a negative influence on the quality. However, the degree of understanding of the relevant processes is currently considered insufficient.

Clients demanding transparency
Clients are demanding a greater say and increasingly require transparency regarding the quality of the drinking water we provide, preferably at the household (or connection) level and at any time of day.

OBJECTIVES OF THIS RESEARCH THEME

- A complete picture of the water quality and the actual risks (chemical and microbiological) at every step of the process
- The ability to monitor and control the water quality at every individual step from source to tap (and in coherence with each other) with sensors
- Gaining insight into the available margins for each process step
- Transparent and clear communication about the water quality with the client and other stakeholders



WORK PACKAGES

Performance
The goal of this work package is to gain insight into the performance demands regarding integral water quality, as well as the way in which this can be presented numerically (per process step). We want to achieve this while taking into account the resources that are available to our clients, as well as available new techniques that allow for more accurate measurements.

Measuring and monitoring
The goal of this work package is to measure and monitor the water quality from source to tap. We want to know which technologies (for example, chemical and (micro)biological screening) and measuring methods to use in determining the water quality.

Anticipating changes in water quality
The goal of this work package is to predict when to expect foreign substances in the abstracted water, what kind of substances these are and subsequently being able to deal with them. This requires clear quality parameters in order to determine when we must take action.

Health and interaction with clients
The goal of this work package is to communicate proactively, clearly and transparently about water quality with clients and stakeholders. We want to know their water quality requirements as well as their informational needs in this respect. Our clients will be involved in quality-focussed research, whereby we aspire to create win-win situations.

Questions, recommendations or advice? Please contact Merijn Schriks, at Merijn.Schriks@vitens.nl

THEME

Treatment

Providing top-quality drinking water for our clients at any time is what we aim for. Adequate treatment that is both robust and flexible is a crucial part of this. Being able to anticipate water quality trends and developments and providing reliable drinking water at any time is essential. This starts with groundwater quality. We aspire to treat with minimal effort so that we do not need to use more commodities and energy than necessary. This requires more fundamental knowledge about treatment processes.

Motive for more research

IT in relation to the process of producing water

Using sensors and calculation models allows for real-time information on water quality and quantity not only during the treatment process, but also before and after. Because of this, it will be possible to remotely control (and optimise) treatment processes and to the predict maintenance requirements of facilities. To control this process, a better insight into chemical, physical and biological treatment processes is essential.

Strange substances

In recent years, the quality of our sources has decreased. Through improved measuring techniques, we more often detect different types of toxic and organic substances. This is also the prospect for the future. In spite of our aim to minimize treatment efforts, advanced treatment techniques are essential (from the source onwards), as are the knowledge and insight in order to apply them.

Sustainability

Resource consumption is being reduced, as are CO2-emissions and energy consumption. Waste flows are optimally utilised. This is the societal challenge that we at Vitens stand for and that also applies to our treatment process. This could include searching for new destinations for residual substances such as the concentrate of membrane filters for brackish groundwater and making use of climate-neutral commodities in the treatment process.

OBJECTIVES OF THIS RESEARCH THEME

- Reliable and stable water quality by automated, standardised and uniform treatment processes
- A treatment process that is able to anticipate external influences on water quality and quantity and answer related questions
- Rendering treatment processes sustainable and providing a high-quality use of all waste flows, including concentrate
- A data-controlled purifying process

WORK PACKAGES

Sand filtration
The goal of this work package is to gain knowledge and models for rapid sand filters remove iron, ammonium and manganese from groundwater. These should result in clear design guidelines, total process control and reduction of particles that enter the distribution network.

Advanced process control
The goal of this work package is an autonomously controlled, managed and optimally functioning treatment process that is continuously connected to other steps of the process. Models, sensors and data (of the treatment process and the laboratory) provide the basis for this. In addition, more knowledge is required regarding the biological, chemical and physical processes that form part of the treatment process.

Resilient purification
The goal of this work package is to develop techniques and knowledge for removing unwanted substances from groundwater, while reducing residual substances (or disposing of these in a high-quality manner). The goal is a fully circular treatment system that is sustainable and can cope with a polluted source.

Questions, recommendations or advice?
Please contact Ron Jong, at Ron.Jong@vitens.nl

A membrane filter is used to abstract salt from the raw water

THEME

Client

Opening Heek

We provide high quality drinking water to 5.6 million clients every day. They did not choose us as their drinking water provider, but just happen to live or work in our supply area. This is why it is even more important that these clients are satisfied with the product, that they are able to take care of water-related matters effortlessly and that we offer them adequate service. They should be able to have a blind trust in these factors, partly through a transparent, proactive and personal information supply.

Motive for more research

Changing needs

Every client is different. Some prioritise safety, while others think sustainability is the most important matter. Clients also demand more transparency about the water quality and quantity that we provide, as well as real-time insight and optimal customer service. The importance of trust in the safety of the water, its distribution and whether it is healthy has grown, especially in view of economic, political and social developments and the amount of information and news sources.

Digitalisation

Increasing possibilities in terms of digitalisation, technology and the use of data can help us with our customer service and can lead to higher client satisfaction. 24/7 service and easily available information and administrative data in line with the needs of the client are possible due to the impact of modernisation and digitalisation.

Social task

Providing drinking water is our legal obligation. Care and attention for our sources is a part of that. Without a source, there is no water. In the areas in which we operate, more and more interests play a role, so we have to search for value creation with other stakeholders, based on mutual ambitions. This also requires the involvement of our clients and awareness of the value of drinking water and groundwater sources.

OBJECTIVES OF THIS RESEARCH THEME

- Offering all relevant real-time information to our clients through digital channels that can be used effortlessly and easily
- Gaining insight into the ideal customer journey and a total view of what clients expect from us. We possess the right tools and skills that are essential in controlling this (in service and infrastructure), so that satisfaction increases and client-related processes become easier.
- Clients taking joint responsibility for a sustainable and continuous availability of drinking water, a clean source and conscious water usage

WORK PACKAGES

Digitalisation and service innovation
The goal of this work package is to adjust service (24/7) to the individual information needs of our clients through digitalisation. A total picture of the ideal customer journey and the usage of client and product data are essential for this. We also require a total view of the contribution that virtual agents and real-time data can make to the 24/7 service. We want to learn from the proven service solutions of other service-oriented companies and optimise the skills of our employees.

Clients as stakeholders
The goal of this work package is to increase the commitment and raise the awareness of our clients regarding the subject of drinking water, both of the product itself and our societal role as a provider of drinking water. Visualising and developing sustainable initiatives together and increasing the appreciation of and mutual responsibility for the quality and quantity of drinking water play a great role in this.

Questions, recommendations or advice?
Please contact Bert Bannink, at Bert.Bannink@vitens.nl

CONCLUSION

This innovation and research agenda has shown you the various challenges we face as a drinking water company, not through an outlined roadmap, but rather through an overview of topics that have priority today in order to secure top-quality drinking water for later. This agenda is intended not only to inform you, but also to motivate you to participate. We hope that you have become as enthusiastic about the future of drinking water as we are, and that you will accept the invitation that this agenda contains. If you have an innovation of a research program that fits perfectly with our challenges, please let us know. We may be able to cooperate.
From source to customer, we invest in the next generation.

Are you in? Contact us at
Jan.Gooijer@vitens.nl

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